

THE STONEFLIES (PLECOPTERA) OF LOUISIANA¹

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ABSTRACT.— A list of species, illustrated keys to nymphs and adults, distribution, and biological notes are presented for 24 stonefly species occurring in Louisiana. *Leuctra moha*?, *Pteronarcys dorsata*, *Helopicus subvarians*, *Paragnetina kansensis*, *Paragnetina immarginata*, *Phasganophora capitata*, and *Acroneuria evoluta* are recorded only from the florida parishes east of the Mississippi River. *Isoperla couchatta*, *Isoperla mohri*, *Neoperla clymene*, an undescribed *Neoperla* (Sp. A), *Paragnetina fumosa*, *Acroneuria abnormis*, *Acroneuria arenosa*, *Perlinella drymo*, and *Perlesta placida* are found both east and west of the Mississippi; and *Allocapnia granulata*, *Allocapnia malverna*, *Amphinemoura nigritta*, and three species of *Taeniopteryx* have been recorded only west of the Mississippi.

Habitats are primarily sand-bottomed streams of pine-hardwood rolling hills, constituting a portion of the western Gulf Coastal Plain. Few stoneflies occur in streams of the Mississippi Alluvial Plain, the Alluvial Atchafalaya Basin, or the lowlands along the Red River.

Distribution and biology of the ecologically important stoneflies are poorly known for the Gulf Coastal Plain Physiographic Province of North America. Because this area was included in Ricker's (1964) "Southeastern" Glacial Refuge, its stonefly fauna has generally been considered similar to that of the Central and Southern Appalachian and Ozark-Quachita provinces. Recent discovery of three new *Leuctra* species and an *Isoperla* (James 1974) from Alabama, the endemicity of *Allocapnia malverna* Ross to the Coastal Plain Province in Texas, Oklahoma, and Arkansas (Stewart et al. 1974), and discovery of two new *Isoperla*, *couchatta* and *sagittata*, from East Texas (Szczytko and Stewart 1976) suggest occurrence of considerable post-pleistocene speciation on the coastal plains.

This paper constitutes a review of Plecoptera known from the West Gulf Coastal Plain and is the first comprehensive treatment of the stoneflies of Louisiana. Previous collection effort is indicated by the fact that only three species, *Acroneuria evoluta* Klapalek, *Perlinella ephyre* (Newman), and *Paragnetina immarginata* (Say), were listed from the state by Illies (1966). Another species, *Isoperla guerinii* (Pictet), was considered by Illies a nomen dubium (et oblitum). Ross and Ricker (1971) plotted four localities in central Louisiana for *Allocapnia malverna* and one for *Allocapnia granulata* (Claassen). Thus, a total of four valid species was attributed to Louisiana in the literature through 1971. Ricker (1972) mentioned the probable scarcity of stone-

flies along the lower Mississippi, and the fact that Louisiana was the only state that he had not visited.

The potential habitats for stoneflies are generally limited in Louisiana to mostly sand-bottomed streams of: (1) the north central and western upland rolling hills, with their oak-hickory and shortleaf-loblolly pine forests, (2) the southwestern and central longleaf-slash pine-deciduous forest, and (3) mixed forests of the florida parish region. The 50-100-mile-wide Mississippi Alluvial Plain of eastern Louisiana, the alluvial Atchafalaya Basin along the lower Mississippi, and the lowlands along the Red River, cutting from the northwestern corner through the central portion of the state, are flat, characterized by sluggish, highly silted streams, and are generally devoid of stoneflies. These physiographic and vegetational features render Louisiana of special interest to furthering knowledge of present distribution and possible past dispersals of Nearctic Plecoptera.

METHODS

We began collecting in Louisiana in 1970. Our effort in the florida parishes was concentrated during the late winter and spring months, Feb.-June, 1971-1973, and in December 1975. Northern and central sections were extensively collected in December 1970, January and December 1971, January, February, and May 1973, and March 1974. Limited collecting at selected points throughout the state was done over the five-year period.

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Collecting expeditions often traversed over 1,000 miles. Streams were collected by a combination of methods, including sweeping streamside vegetation, using kick nets in riffles, actively searching through leaf debris, removing and scrutinizing submerged logs, actively searching among rocks and debris along stream margins, tapping emergent vegetation with a stick (good method for adult *Taeniopteryx*), searching surfaces and cracks around bridges and in some instances searching around nearby lights at night or operating a fluorescent light device at streamside.

Distributional data and/or specimens were obtained from Louisiana State University at Baton Rouge, Smithsonian Institution, Harvard Museum of Comparative Zoology, University of Utah, University of Kansas, and the Illinois Natural History Survey.

The aedeagi of males were extruded by squeezing at time of collection or with forceps in preserved specimens after clearing in a 5 percent solution of KOH. Specimens of *Isoperla* were compared to the types of *Isoperla mohri* Frison, *Isoperla namata* Frison, *Isoperla richardsoni* Frison, and *Isoperla couchatta* Szczytko and Stewart. The recent revisions by Stark and Gaufin (1976a, b) were followed in determinations of Perlidae. Ova were dissected from gravid females, mounted according to the techniques of Koss (1968), and examined using a Zeiss photomicroscope equipped with phase contrast and Nomarski interference con-

trast. Photographs of ova were taken from specimens collected in the indicated Coastal Plains state.

List of Louisiana Stoneflies
Systematic Treatment according to
Zwick (1973)

- Suborder Arctoperlaria
 - Group Euholognatha
 - Family Leuctridae
 - 1. *Leuctra moha?* Ricker¹.
 - Family Taeniopterygidae
 - 2. *Taeniopteryx burksi* Ricker and Ross⁴.
 - 3. *Taeniopteryx lita* Frison⁴.
 - 4. *Taeniopteryx loniceria* Ricker and Ross⁴.
 - Family Nemouridae
 - 5. *Amphinemura nigritta* (Provancher)⁴.
 - Family Capniidae
 - 6. *Allocapnia granulata* (Claassen).
 - 7. *Allocapnia malverna* Ross.
 - Group Systellognatha
 - Family Pteronarcyidae
 - 8. *Pteronarcys dorsata* (Say)⁴.
 - Family Perlodidae
 - 9. *Helopicus subvarians* (Banks)⁴.
 - 10. *Isoperla couchatta* Szczytko and Stewart⁴.
 - 11. *Isoperla mohri* Frison⁴.
 - 12. *Isoperla* sp. A.
 - Family Perlidae
 - 13. *Neoperla clymene* (Newman)⁴.
 - 14. *Neoperla* sp. A.
 - 15. *Paragnetina fumosa* (Banks)⁴.
 - 16. *Paragnetina immarginata* (Say).
 - 17. *Paragnetina kansensis* (Banks)⁴.
 - 18. *Phasganophora capitata* (Pictet)⁴.
 - 19. *Acroneuria abnormis* (Newman)⁴.
 - 20. *Acroneuria arenosa* (Pictet)⁴.
 - 21. *Acroneuria evoluta* Klapalek.
 - 22. *Perlesta placida* (Hagen)⁴.
 - 23. *Perlinella drymo* (Newman)⁴.
 - 24. *Perlinella ephyre* (Newman).

Key to the Adult Stoneflies of Louisiana

- 1. Paraglossae and glossae equal in length (Fig. 1) 2
- Paraglossae longer than glossae (Fig. 2) 6
- 2(1). Gill remnants present on thorax and first two abdominal sterna; body length greater than 20 mm ... Pteronarcyidae; *Pteronarcys dorsata*⁵. Gill remnants absent from abdominal sterna; body length less than 15 mm 3
- 3(2). First and second tarsal segments approximately equal in length; coxae with small round membranous area ventrally (Fig. 5) *Taeniopterygidae*; *Taeniopteryx* 19
- Second tarsal segment shorter than first (Fig. 6); coxae without membranous area ventrally 4
- 4(3). Cerci multisegmented. Capniidae; *Allocapnia* 21
- Cerci with one segment 5
- 5(4). Apical marginal space of forewing with oblique crossvein (Fig. 10); cervical gills present Nemouridae; *Amphinemura nigritta*

⁵Louisiana records represented by nymphs only.

- Apical marginal space of forewing without oblique crossvein; cervical gills absent *Leuctridae*; *Leuctra moha*?⁶.
- 6(1). Gill remnants usually present on sides and venter of thorax; arms of mesosternal Y-ridge poorly developed, but reaching to, or near, anterior corners of furcal pits (Fig. 4). *Perlidae* 7
 Gill remnants absent from sides and venter of thorax; arms of mesosternal Y-ridge well developed and reaching posterior corners of furcal pits (Fig. 3). *Perlodidae* 18
- 7(6). Apex of abdomen with a pair of dorsal sclerotized genital hooks (Figs. 11, 12) 8
 Apex of abdomen without dorsal hooklike structures; posterior margin of eighth sternum variously modified 13
- 8(7). Genital hooks developed from hind margin of tergum 10 anterior to cerci (Fig. 11); abdominal sternum without a hammer 9
 Genital hooks developed from paraprocts, originating below cercal bases (Fig. 12); abdominal sternum 9 with or without hammer 11
- 9(8). Two ocelli *Neoperla clymene*⁷
 Three ocelli 10
- 10(9). Genital hooks projecting to anterior margin of tergum
 *Phasganophora capitata*
 Genital hooks projecting to middle of tergum 9. *Paragnetina* 22
- 11(8). Sternum 9 without a hammer *Perlesta placida*
 Sternum 9 with a hammer (Fig. 13) 12
- 12(11). Forewing with at least one crossvein beyond the anal cell between A¹ and A² (Fig. 9) *Perlinella* 24
 Forewing without crossveins beyond anal cell between A¹ and A²; patches of spinules on abdominal terga 9 and 10 (Fig. 12) *Acroneuria* 25
- 13(7). Forewing with at least one crossvein beyond the anal cell between A¹ and A² (Fig. 9). *Perlinella* 24
 Forewing without crossveins beyond anal cell between A¹ and A² 14
- 14(13). Two ocelli *Neoperla clymene*⁷
 Three ocelli 15
- 15(14). Subgenital plate with median notch on posterior margin 16
- 16(15). Forewing length less than 15 mm *Perlesta placida*
 Forewing length more than 17 mm *Paragnetina* 22
- 17(15). Thoracic sterna with transverse dark bands of pigmentation
 *Phasganophora capitata*
 Thoracic sterna without dark bands of pigmentation. *Acroneuria* 25
- 18(6). Submental gills present; male tergum 10 cleft; wings and most of body black *Helopicus subvarians*⁵
 Submental gills absent; male tergum 10 entire; wings and body color variable, pale yellow to brown. *Isoperla* 27
- 19(3). Vesicle usually present on male sternum 9; paraprocts narrow and pointed at tip; notch of female subgenital plate margined by dark V-shaped bands *Taeniopteryx burksi*

⁶Louisiana record consists of one female from Washington Parish.

⁷The genus *Neoperla* is presently under revision; some specimens will be a second species (see *Neoperla* Species A, section following).

⁸*A. mela* will key here also.

- Vesicle absent from male sternum 9; paraprocts broad at base and truncate or broadly rounded at tips; notch of female subgenital plate margined by dark U-shaped band 20
- 20(19). Basal width of paraprocts equal to or greater than length
 *Taeniopteryx lita*
 Basal width of paraprocts approximately half the length
 *Taeniopteryx lonicera*
- 21(4). Process of male tergum 8 cleft; female subgenital plate pointed mesally *Allocaenia granulata*
 Process of male tergum 8 entire; female subgenital plate with apical margin convex *Allocaenia malverna*
- 22(10,16). Body color pale yellow; male tergum 5 unproduced
 *Paragnetina immarginata*
 Body color dark brown to black; male tergum 5 posteriorly produced and mesally notched 23
- 23(22). Male genital hooks pointed at apex; ovum with collar at least half as wide as greatest diameter *Paragnetina immarginata*
 Male genital hooks bluntly rounded at apex; ovum with collar less than one-third greatest diameter *Paragnetina fumosa*
- 24(12,13). Pronotum with median dark band of pigmentation *Perlinella drymo*
 Pronotum without distinctive color pattern *Perlinella ephyre*
- 25(12,17). Male paraprocts broadly triangular and flattened; female subgenital plate not produced *Acroneuria abnormis*
 Male paraprocts slender, fingerlike; female subgenital plate produced over at least one-third of sternum 9 26
- 26(25). Male paraprocts notched apically; female subgenital plate truncate *Acroneuria arenosa*
 Male paraprocts evenly tapered to a point; female subgenital plate rounded, lateral margins constricted *Acroneuria evoluta*^s
- 27(18). Abdominal terga with longitudinal rows of dots; male paraprocts not produced over tergum 10; female subgenital plate rounded
 *Isoperla mohri*
 Abdominal terga without rows of dots; male paraprocts produced over tergum 10; female subgenital plate triangular in outline
 *Isoperla couthatta*

Key to Nymphal Stoneflies of Louisiana

1. Paraglossae and glossae equal in length (Fig. 1) 2
 Paraglossae longer than glossae (Fig. 2) 6
- 2(1). Branched gills present on thorax and first two abdominal sterna
 Pteronarcyidae; *Pteronarcys dorsata*
 Gills absent from abdominal sterna 3
- 3(2). Unbranched, fingerlike gills present on each coxa; first and second tarsal segments approximately equal
 Taeniopterygidae; *Taeniopteryx*
 Coxae without gills 4
- 4(3). Branched cervical gills present; hind wingpads widely divergent
 Nemouridae; *Amphinemura nigritta*
 Cervical gills absent; hind wingpads parallel to axis 5
- 5(4). Abdominal terga with distinct posterior setal fringe; segments 1-9

- divided laterally by membranous fold (Species indistinguishable at this time). Capniidae; *Allocapnia*
 Abdominal terga without posterior setal fringe; segments 1-6, at most, divided by lateral membranous fold Leuctridae; *Leuctra*
- 6(1). Branched gills present on sides and ventor of thorax. Perlidae 7
 Branched gills absent from thorax. Perlodidae 12
- 7(6). Occiput with a straight, evenly spaced, complete row of spinules (Fig. 7) 8
 Occiput with or without spinules, if present, the row is sinuate, unevenly spaced or incomplete (Fig. 8) 10
- 8(7). Two ocelli *Neoperla clymene*
 Three ocelli 9
- 9(8). Abdominal terga 1-9 with numerous scattered spinules in addition to posterior fringe. *Paragnetina* 13
 Abdominal terga 1-9 with 5 or less scattered spinules
 *Phasganophora capitata*
- 10(7). Occiput with a sinuate, unevenly spaced row of spinules; abdominal terga freckled *Perlesta placida*
 Occiput with, at most, a few spinules near postocular fringe; abdominal terga without freckles 11
- 11(10). Postocular spinule row reduced to a single seta, or absent; pronotum without well-developed setal fringe. *Perlinella* 15
 Postocular spinule row with several stout setae; pronotum with front and hind margins fringed with spinules. *Acroneuria* 16
- 12(6). Submental gills present (Fig. 2)..... *Helopicus subvarians*
 Submental gills absent. *Isoperla* 18
- 13(9). Abdominal terga patterned in yellow and brown; a longitudinal mesal fringe of long setae extending from head to apex of abdomen *Paragnetina immarginata*
 Yellow pigmentation absent or restricted to a few abdominal terga; body without a mesal longitudinal fringe of setae 14
- 14(13). Brown pigmentation extending completely across frons forward of median ocellus *Paragnetina kansensis*
 Brown pigmentation interrupted on frons by a longitudinal stripe of yellow forward of median ocellus *Paragnetina fumosa*
- 15(11). Two ocelli *Perlinella ephyre*
 Three ocelli *Perlinella drymo*
- 16(11). Anal gills absent *Acroneuria abnormis*
 Anal gills present 17
- 17(16). Abdominal terga with alternating transverse bands of brown and yellow; dorsum of head with broad yellow W-mark
 *Acroneuria evoluta*
 Abdominal terga without distinct transverse yellow bands; head pattern variable *Acroneuria arenosa* and *mela*
- 18(12). Maxillary lacinia with a single tooth and setae present along its entire inner margin, continuing around the outer margin; mandibles deeply cleft with serrations on inner margin of outer tooth *Isoperla mohri*
 Maxillary lacinia with two apical teeth and complete inner row of setae; mandibles shallowly cleft, with no serrations on outer tooth *Isoperla couchatta*

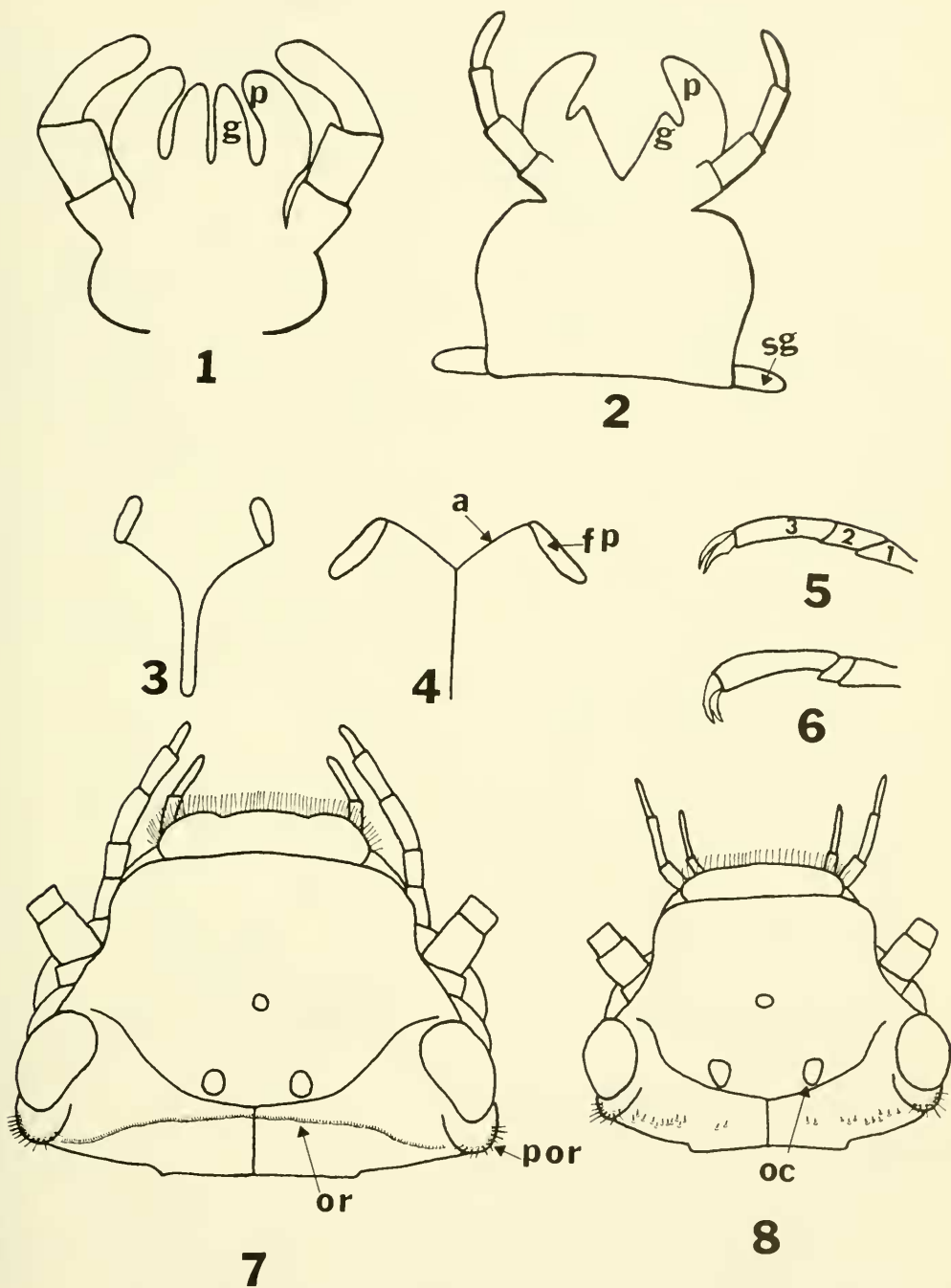
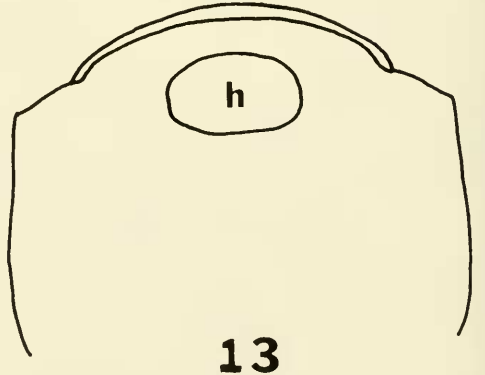
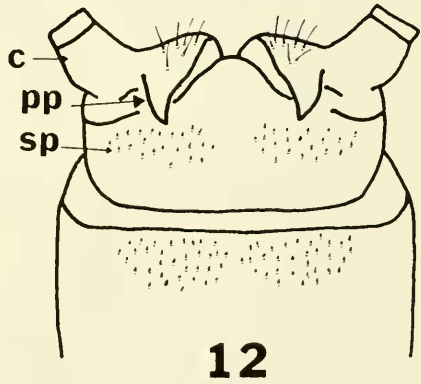
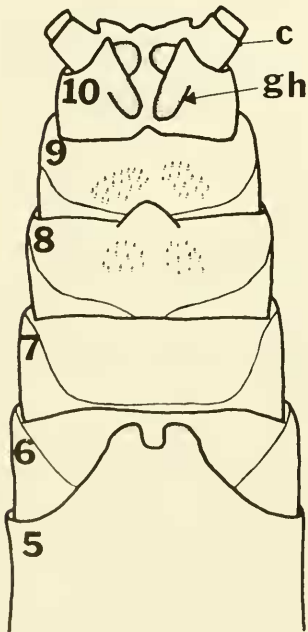
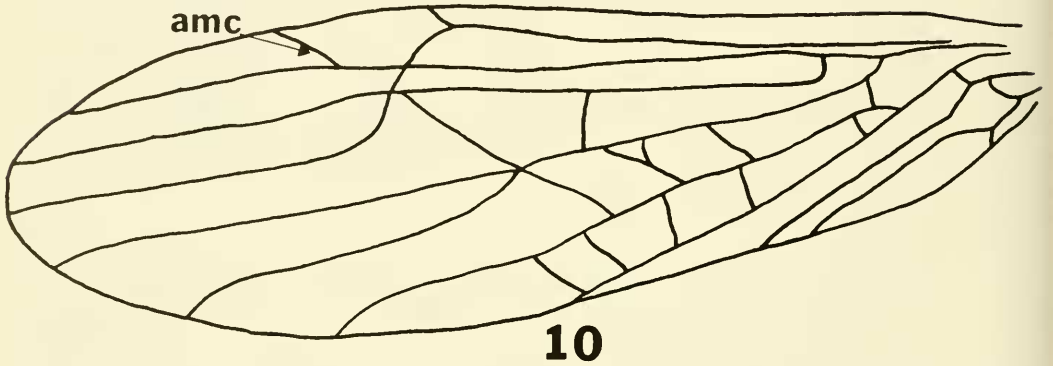
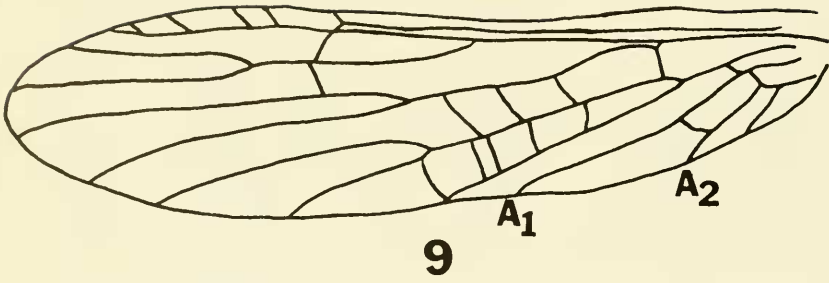


Fig. 1-8. Louisiana Plecoptera: 1, *Pteronarcys*, nymphal labium (p = paraglossae, g = glossae); 2, *Hydroperla crosbyi*, nymphal labium (sg = submental gill); 3, *H. crosbyi*, nymphal mososternal grooves; 4, *Paragnetina fumosa*, nymphal mososternal grooves (a = arm of Y-ridge, fp = furcal pit); 5, *Taeniopteryx lita*, nymphal tarsi; 6, *Allocapnia granulata*, nymphal tarsi; 7, *Paragnetina fumosa*, nymphal head (or = occipital spinule row, por = post occular spinule row); 8, *Perlesta placida*, nymphal head (oc = anal crossvein).



Figs. 9-13. Louisiana Plecoptera: 9, *Perlidella ephyre*, forewing (ac = anal crossvein); 10, *Amphinemura nigritta*, forewing (amc = apical marginal crossvein); 11, *Paragnetina fumosa*, male terminalia (c = cercus, gh = genital hook); 12, *Aroneuria abnormis*, male terminalia (c = cercus, pp = paraproct, sp = spinule patch); 13, *Aroneuria arenosa*, male sternum 9 (h = hammer).

Leuctra moha? Ricker

Leuctra moha Ricker, 1952: 171.

DISTRIBUTION IN LOUISIANA: WASHINGTON, Small Creek Jct. Hwy 10-62 near Sheridan (Fig. 14).

Only one female was collected at the above locality by K. W. Stewart, R. W. Baumann, and B. P. Stark, December 1, 1975. It fits the description and illustration of a supposed *Leuctra moha* female (Ricker 1952, Fig. 123). The collector, Dr. P. W. Fatig, had taken two types of females along with the holotype; the one illustrated was more accordant in size to the holotype, but Ricker noted that correlation was not certain. All previously reported records of this species have been from Georgia (Ricker 1952), during the month of October. No *Leuctra* species have been reported from immediately adjacent states; however, approximately 12 species occur from the Carolinas westward (Illies 1966). James (1974) reported three new *Leuctra* from the Gulf Coastal Plain state of Alabama, in addition to *Leuctra biloba* Claassen and *Leuctra alexanderi*

Hanson. Harley P. Brown recently sent us a *Leuctra* nymph from Tishomingo County, Mississippi.

Taeniopteryx burksi Ricker and Ross

Taeniopteryx burksi Ricker and Ross, 1968: 1425.

DISTRIBUTION IN LOUISIANA: BIENVILLE, Black Lake Bayou; Saline R. (plus other parishes from which only presently indistinguishable *Taeniopteryx* nymphs have been collected, Fig. 15).

We collected a large series of adults and only two nymphs at the above two localities in Bienville Parish on 4 February 1972, indicating a January-February emergence. This widely distributed species emerges as late as April in Quebec (Harper and Magnin 1969). In Canada eggs hatch a few weeks after deposition, nymphs undergo a long summer diapause until fall, and then nymphs grow very rapidly (Harper and Hynes 1970; Harper and Magnin 1969). Nymphs occur in debris in small sand-bottom streams and slow-flowing bayous; good results in

- *Leuctra moha?*
- *Allocapnia granulata*
- ▲ *A. malverna*
- *Allocapnia* sp. nymphs
- *Amphinemura* sp.
- ▲ *Amphinemura nigritta*
- *Pteronarcys dorsata*

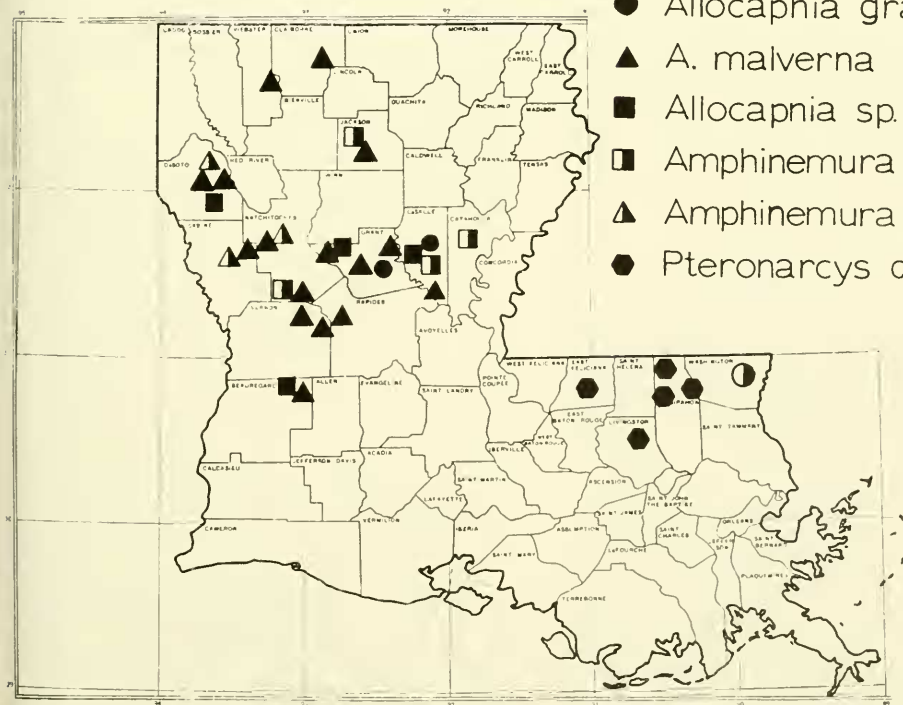


Fig. 14. Distribution of Capniidae, Nemouridae, and Pteronarcyidae in Louisiana.

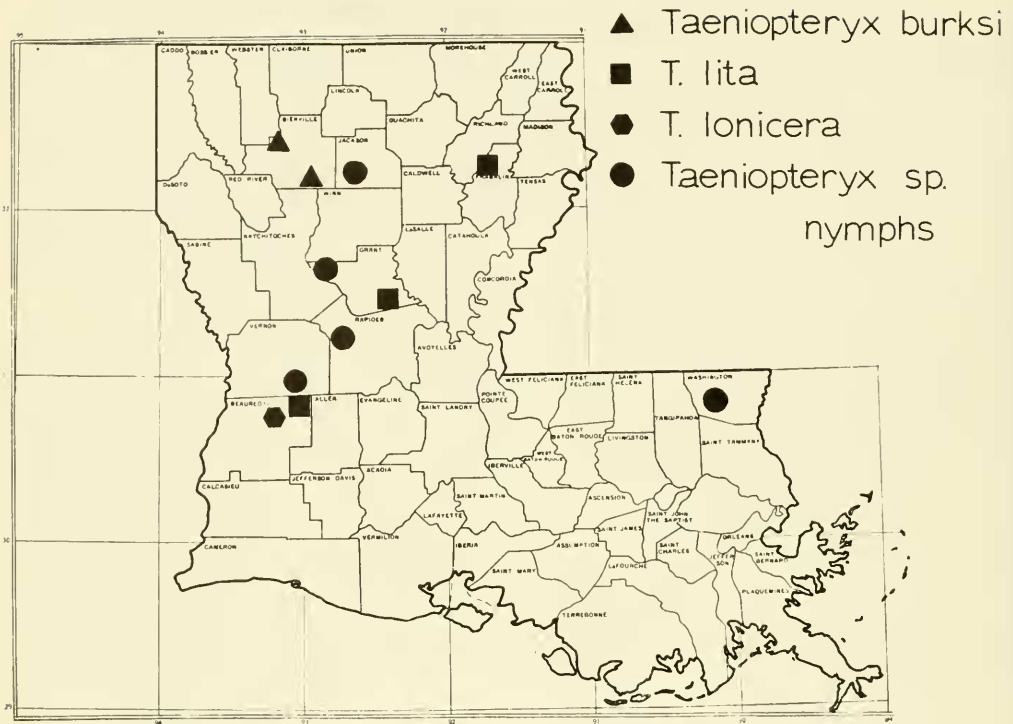


Fig. 15. Distribution of *Taeniopterygidae* in Louisiana.

collecting adults can be obtained by tapping emergent vegetation sharply with a stick or net handle, then netting the adults from the water's surface. Nymphs have been figured by Harper and Hynes (1971), but since *lonicera* and *lita* nymphs are undescribed, Louisiana specimens cannot be separated with confidence.

Taeniopteryx lita Frison

Taeniopteryx lita Frison, 1942: 249.

DISTRIBUTION IN LOUISIANA: BEAUREGARD, Whiskey Chitto Cr. FRANKLIN, Big Cr. GRANT, 1 mi SE Montgomery; near Pollock (Fig. 15).

This species and *lonicera* can be distinguished from *burksi* by absence of a vesicle on sternite⁹ and by the broadly rounded or truncate tips of their paraprocts. Adults appear in December and January in Louisiana. In their revision of *Taeniopteryx*, Ricker and Ross (1968) reported this species from adjacent Mississippi. It also occurs in the east Texas pine hills in sluggish streams and bayous (Stewart et al. 1974; Szczytko and Stewart 1977). A closely related species, *T. starki*, occurs in the sluggish Leon River in central Texas (Stewart and Szczytko 1974). Il-

lustrations of the adult genitalia and wings were given by Frison (1952). Our examination of the holotype from the INHS indicated that the dorsal processes of the cerci are much stouter than the "small and finger-like" description and illustration given by Frison (1942). Hitchcock (1974) and Stewart and Szczytko (1974) illustrated the male paraprocts, and Stewart and Szczytko (1974) compared the central plate (subgenital plate) of the female abdominal sternum 8 of *T. lita*, *T. lonicera*, and *T. starki*. The nymph of *T. lita* is undescribed.

Taeniopteryx lonicera Ricker and Ross

Taeniopteryx lonicera Ricker and Ross, 1968: 1427.

DISTRIBUTION IN LOUISIANA: BEAUREGARD, Whiskey Chitto Cr. (Fig. 15).

Two males were collected with a large number of *T. lita* on 26 December 1970, in Whiskey Chitto Creek. They exhibit the distinct slender, twisted cerci, with inner surfaces deeply excavated for the distal 0.7 of its length, and paraprocts as illustrated by Ricker and Ross (1968). This species has been reported from adja-

cent Mississippi (Ricker and Ross 1968) and Texas (Stewart et al. 1974; Szczytko and Stewart 1977). The nymphs are undescribed and the life cycle unreported.

Amphinemura nigritta (Provancher)

Nemoura nigritta Provancher, 1876: 214.

Nemoura venosa Banks, 1897: 21.

Nemoura stylata Banks, 1920: 324.

Nemoura nigritta, venosa. Claassen, 1940: 60, 66.

Nemoura (*Amphinemura*) *nigritta*. Ricker, 1952: 25.

Nemoura nigritta, venosa. Gaufin, 1956: 322.

DISTRIBUTION IN LOUISIANA: CATAHOULA, Birds Cr.; DESOTO, Four Mile Bayou; JACKSON, unnamed stream; LASALLE, Troit Cr.; NATCHITOCHEs, Kisatchie Cr., Winn Cr.; SABINE, Blackwell Cr.

This species is distributed primarily in central and western Louisiana (Fig. 14). Ricker (1952) illustrated variations in the male paraprocts; the present name *nigritta* probably includes a complex of species. The paraprocts of Louisiana males vary from those figured by Ricker (1952) and Hitchcock (1974) and may be an undescribed species. Specimens have been sent to R. W. Baumann for further study. Adults have been collected in March-April, and nymphs as late as 14 April. Hitchcock (1974) reported a May to mid-June emergence in Connecticut and indicated that adults came to blacklights traps. Nymphs have been figured by Claassen (1931) and Harper and Hynes (1971). Harper (1973b) described the life cycle. Louisiana nymphs have four branched cervical gills, appearing as prominent gill tufts in the neck region.

Allocapnia granulata (Claassen)

Capnella granulata Claassen, 1924: 44.

DISTRIBUTION IN LOUISIANA: LASALLE, Hairs Cr. GRANT, Small stream 1 mi N Pollock; central Louisiana (one plot. Ross and Ricker 1971).

This widely distributed eastern species is apparently much less common than *A. malverna* and appears to be restricted to the pine hills near the Kisatchi National Forest in central Louisiana (Fig. 14). Stark and Stewart (1973) and Stewart et al. (1974) reviewed its distribution in adjacent states of Oklahoma and Texas. Adults appear in December-January and probably undergo a nymphal diapause in summer (Harper and Hynes 1970) with rapid nymphal development in the

fall. Frison (1929) discussed the life cycle and habits in Illinois. Excellent accounts and illustrations of the morphology of adults, Nearctic distribution, and evolution are given by Ross and Ricker (1971). Nymphs were figured by Frison (1929), Harden and Mickel (1952), and Harper and Hynes (1971).

Allocapnia malverna Ross

Allocapnia malverna Ross, 1964: 170.

DISTRIBUTION IN LOUISIANA: BEAUREGARD, Whiskey Chitto Cr. CLAIBORNE, 2 mi E Lisbon; DESOTO, 2 and 4 mi E Mansfield; GRANT, 6 mi S Georgetown, 1 mi SE Montgomery. JACKSON, unnamed stream. NATCHITOCHEs, Kisatchie Cr.; Winn Cr. RAPIDES, Hemphill Cr. VERNON, Calcasieu R.; Comrade Cr. WEBSTER, 6 mi E Minden. LASALLE, 15 mi SW Jena; Earl Cr.; Whitewall (Ross and Ricker 1971).

A. malverna appears to be restricted to the western Gulf Coastal Plain of Louisiana (Fig. 14) and adjacent states of Arkansas (Ross and Ricker 1971), Oklahoma (Stark and Stewart 1973), and Texas (Stewart et al. 1974; Szczytko and Stewart 1977). Males are figured by Ross and Ricker (1971); females cannot at present be distinguished from *mohri* and *mystica* (both figured by Ross and Ricker 1971). We have collected adults from 26 December to 5 February in Louisiana. Nymphs are undescribed, and the life cycle is unknown.

Pteronarcys dorsata (Say)

Sialis dorsata Say, 1823: 164.

Pteronarcys regalis Newman, 1838: 176.

Kollaria insignis Pictet, 1841: 123.

Pteronarcys nobilis Hagen, 1861: 15.

Pteronarcys frigida Gerstaecker, 1873: 65.

Pteronarcys rectus Provancher, 1876: 191.

Pteronarcys flavicarnis Provancher, 1876: 191.

Pteronarcys labradoriensis Samal, 1933: 95.

Pteronarcys shelfordi Frison, 1934: 25.

DISTRIBUTION IN LOUISIANA: E. FELICIANA? (label = Fla? Parish). LIVINGSTON, Tickfaw R. TANGIPAHOA, Tchefuncta R.: .5 mi E Kentwood.

Only nymphs of this *Pteronarcys* have been collected from 29 January to 27 May in Louisiana. The backward projection of sternum 9 in male nymphs is wider and has the sides more parallel as described and illustrated by Harden and Mickel (1952, Fig. 7 of Plate IX). Male nymphs of *pictetii* exhibit a subtriangular projection (Harden and Mickel 1952, Fig. 8 of Plate IX). Female nymphs collected

in May 1972 and 1973 are over 40 mm in length. Harden and Mickel (1952) stated that female Minnesota nymphs of both *dorsata* (over 40 mm) and *pictetii* (less than 39 mm) could be consistently differentiated by their size. Nymphs are found clinging to logs in larger rivers in the florida parishes (Fig. 14), and emergence probably occurs in May and June. The range of *dorsata* is perhaps the widest of any Nearctic stonefly, being transcontinental from Alaska to Labrador in the north, extending down the Cordillera to Wyoming in the west, and previously to Georgia in the east. Louisiana is the farthest southwestward that the species has been reported, so collection and study of the morphology and biology of adults is needed. Nebeker (1971) reported the effects of different laboratory temperatures on development, feeding, emergence, egg production, and adult longevity. Nelson and Hanson (1971) figured adult genitalia, and Needham and Claassen (1925) and Knight et al. (1965) figured the egg. Hoke (1924) illustrated the head and mouthparts of a nymph that might have been *dorsata*.

Helopicus subvarians (Banks)

Perla subvarians Banks, 1920: 317.
Perla postica Needham and Claassen, 1925: 82.
Perla tincta Needham and Claassen, 1925: 89.
Perla tinctata Claassen, 1936: 623.
Hydroperla subvarians. Frison, 1942: 292.
Isogenus (Helopicus) subvarians. Ricker, 1952: 103.

DISTRIBUTION IN LOUISIANA: TANGIPAHOA, Terry Cr. Washington, Tchefuncta R. Hays Cr. 3 mi S Jct. 25-38 near Clifton.

Only the distinctive nymphs with a black band across the head (Ricker 1952) have been collected east of the Mississippi River (Fig. 16) in Louisiana. Little is known of the biology of this species. Hitchcock (1974) based its presence in Connecticut also on nymphal collections.

Isoperla couchatta Szczytko and Stewart

Isoperla couchatta Szczytko and Stewart, 1976: 99.
 DISTRIBUTION IN LOUISIANA: CATAHOULA, tributary Bird Cr. LASALLE, Hemphill Cr.; Trout Cr. LINCOLN, Bayou D'Arbonne. NATCHITOCHEs, Kisatchie Cr.; Middle Cr. RAPIDES, Castor Cr. TANGIPAHOA, Terry Cr. WASHINGTON, Hays Cr.

This species is distributed in small, sand-bottomed creeks throughout central

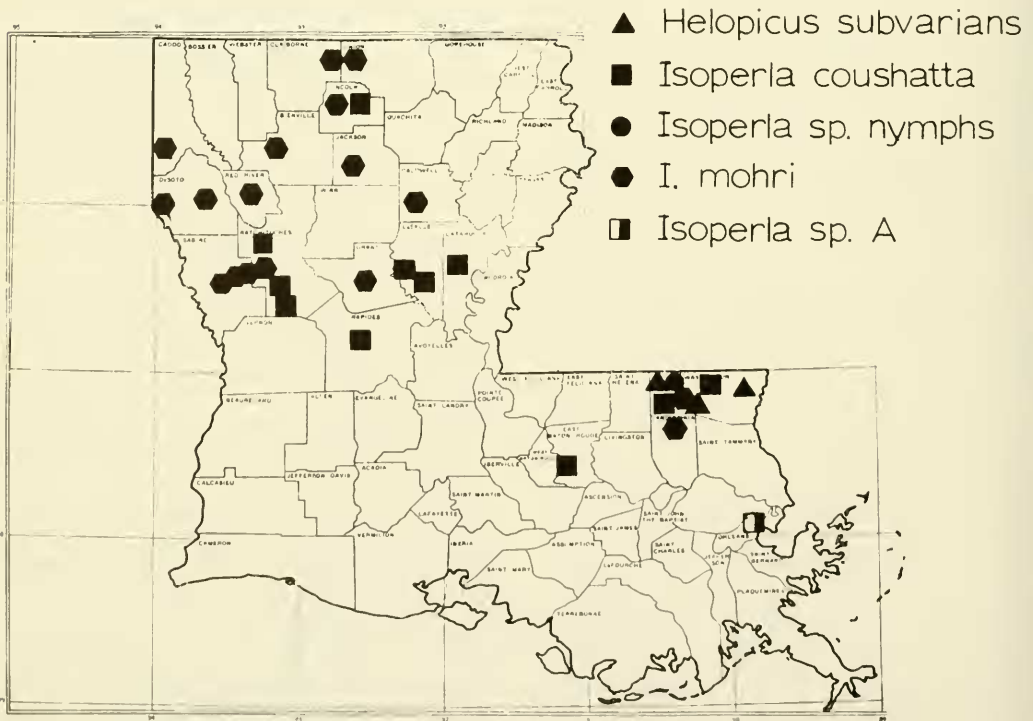


Fig. 16. Distribution of Perlodidae in Louisiana.

and northern Louisiana and the northern florida parish region (Fig. 16). The male aedeagus is entirely membranous, somewhat club-shaped when extruded, and the female subgenital plate is triangular, produced backward over not more than one-third of the sternum 9. The lacinia of the nymph has two apical teeth and a complete inner row of setae. Nymphal mandibles are shallowly cleft, with no serrations on the outer tooth. Szczytko and Stewart (1976) figured the terminalia and extruded aedeagus of the male, subgenital plate and terminalia of the female, and complete mouthparts of the nymphs. Adults were taken in April in Louisiana.

Isoperla mohri Frison

Isoperla mohri Frison, 1935: 455.

DISTRIBUTION IN LOUISIANA: BIENVILLE. Black Lake Bayou. CADDO. 6 mi N Jct. 525-169. CALDWELL. unnamed stream. CLAIBORNE. Corney Lake Spillway. DESOTO. 3 mi E Mansfield. 4 mi N Logansport. GRANT. unnamed stream. JACKSON. 11 mi E Jonesboro. LINCOLN. Bayou D'Arbonne. RED RIVER. Grand Bayou. SABINE. Blackwell Cr.: Phillips Cr.: 3 mi W Robeline. TANGIPAHOA. Wilson Branch. 5 mi E Wilmer. UNION. Little Corney Bayou.

This species is widespread in Louisiana west of the Mississippi (Fig. 16), east Texas (Szczytko and Stewart 1976, 1977), and Oklahoma (Stark and Stewart 1973). It has been previously reported only from Illinois and Missouri. The male aedeagus bears a distinct posterior spine below which is a double row of sclerotized fingers (Szczytko and Stewart 1976); the paraprocts are reduced, not curving up over tergum 10 as in most *Isoperla*. The female subgenital plate is broadly rounded, sometimes with a shallow notch, and is much produced, covering most of the sternum 9. Nymphs have distinctive mouthparts. Their mandibles are deeply cleft, with serrations on the inner margin of the outer tooth. The lacinia bears a single apical tooth, with setae present along the entire inner margin, continuing around the outer margin; paraglossae bear a distinct apical nipple. The emergence of *I. mohri* is spontaneous, apparently cued to water temperature, and lasts usually less than two weeks in late March to mid-April. Frison (1935) figured the genitalia, nymph, and nymphal mouthparts. Szczytko and Stewart (1976) gave a detailed analysis of the species and figured

the male aedeagus and genitalia, female subgenital plate and terminalia, and nymphal mouthparts.

Isoperla sp. A.

One fully winged male *Isoperla* from the Tulane University collection, labeled La. N. O. 19-IV-51. J. H., Lot No. 2425, appears to be an undescribed species. It is similar to *I. longiseta*, differing primarily in having shorter paraprocts, lack of distinct spinule patterns on tergas 9 and 10, and different shape of the lobe on the posterior margin of sternum 8. We are attempting to collect additional specimens.

Neoperla clymene (Newman)

Chloroperla clymene Newman, 1839: 87.

Perla occipitalis Pictet, 1841: 254.

DISTRIBUTION IN LOUISIANA: BEAUREGARD. Bayou Abococo; Bundick Cr.; Whiskey Chitto Cr. CATAHOULA. Birds Cr. tributary. EAST BATON ROUGE. Baton Rouge. EAST FELICIANA, near Magnolia. GRANT. Big Cr.; Fish Cr.; Camp Hardtner; Pollock. LASALLE. Trout Cr. LIVINGSTON. Little Natalbany R.; Tickfaw R.; near Magnolia. RAPIDES. Germany Branch; Hemphill Cr.; Spring Cr. St. HELENA. Amite R. TANGIPAHOA. Big Cr. WASHINGTON. Bogue Chitto R.; Hays Cr.; Little Silver Cr.; Mill Cr.

This is one of the most frequently encountered species in the state (Fig. 17) and throughout the Gulf Coastal Plains, although population densities are seldom great. Stewart et al. (1974) discussed the Nearctic distribution and unique southwestern relict populations of the species. Stark and Gaufin (1976a) have subsequently pointed out the existence of a complex of several species which are currently under revision. Louisiana materials examined as part of this revision reveal the presence of a second form herein designated "Species A." Vaught and Stewart (1974) detailed the life history and ecology of *N. clymene* based on a study of Texas populations. Accounts and illustrations of adult morphology were given by Stark and Gaufin (1976a). Nymphs were figured by Frison (1935) but are not definitely associated with this species. Photographs of eggs definitely of this species are found in Vaught and Stewart (1974) and Stark and Gaufin (1976a). Details of the chorion and collar are shown in Fig. 20.

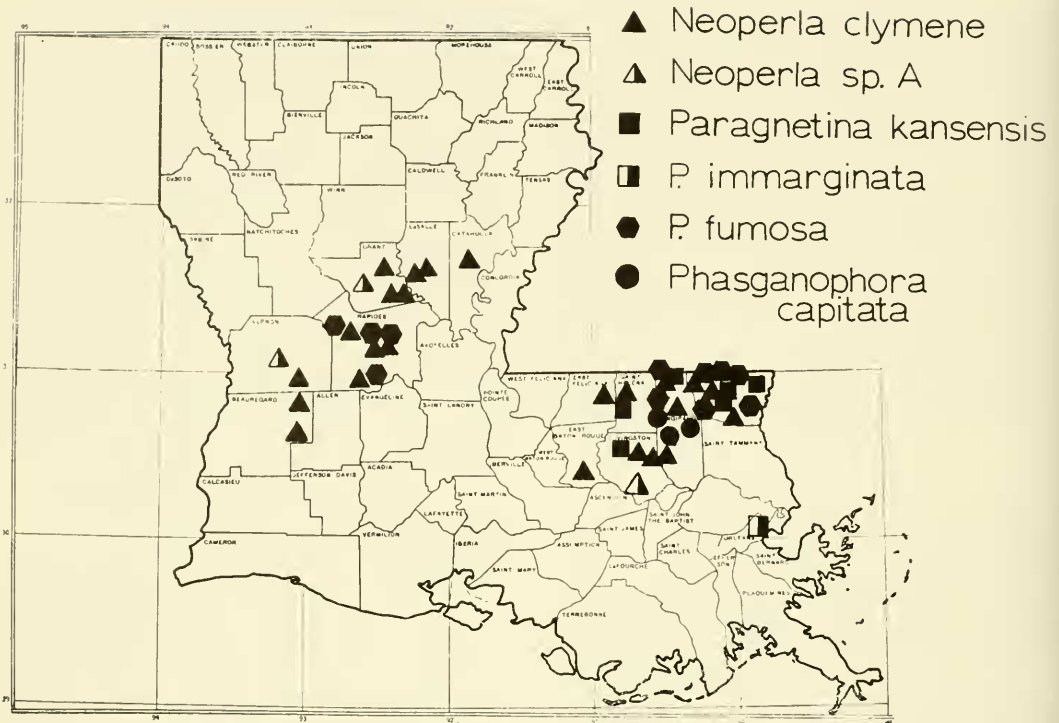


Fig. 17. Distribution of Perlinae in Louisiana.

Neoperla sp. A

DISTRIBUTION IN LOUISIANA: GRANT, near Pollock. LIVINGSTON, Little Natalbany R. VERNON, Ft. Polk.

This is a smaller and more darkly pigmented form than typical *clymene*. The two species broadly overlap in range over the Gulf Coastal Plains and have been taken together in the same light trap collection in Livingston Parish (Fig. 17). Eggs dissected from gravid females are shown in Figs. 21 and 22. The chorion is finely and regularly punctate, which contrasts markedly with the striate pattern of typical *clymene* (Fig. 20).

Paragnetina fumosa (Banks)

Perla fumosa Banks, 1902: 123.
Perla immarginata Needham & Claassen, 1925: 102.

DISTRIBUTION IN LOUISIANA: RAPIDES, Castor Cr.; Germany Br.; Hemphill Cr.; Spring Cr.; ST. HELENA, 5 mi E Chipola. TANGIPAHOA, Terry Cr. TANGIPAHOA-ST. TAMMANY, Tchoufoucta R. WASHINGTON, Silver Cr.; Bogue Chitto R.; Hays Cr.; 5 mi E Franklin; Jct. Hwy. 10-62; 3 mi S Jct. 25-38 near Clifton.

This is the common *Paragnetina* species of the Gulf Coastal Plains. Stewart

et al. (1974) discussed its distribution, which extended westward to the Blackland Prairie of Texas. Two population centers have been located in Louisiana, one in the Kisatchie National Forest and the other in the Florida parishes (Fig. 17). Ricker (1949) figured the adult genitalia. Nymphs are undescribed but, based on our reared material, may be distinguished from *kansensis* by the color variation noted in the key. Like *kansensis*, female nymphs possess anal gills. No published data are available on the life history or behavior of this species. The egg (Fig. 23) is oval with a distinctly stalked collar. The lip of the collar is bent outward and has irregular, sharp emarginations; chorionic reticulation is not evident.

Paragnetina immarginata (Say)

Sialis immarginata Say, 1823: 164.
Perla lurida Hagen, 1861: 21.

DISTRIBUTION IN LOUISIANA: ORLEANS, New Orleans (Fig. 17).

The record of this species in Louisiana is based on Hagen's *Perla lurida* type specimens in the MCZ and on a similar

specimen mentioned by Ricker (1949) among Klapalek's material. No recent material of this Appalachian species has been taken in the state; and, based on its present distribution and habitat preference of cool mountain streams, it is doubtful that any will be forthcoming.

Paragnetina kansensis (Banks)

Perla kansensis Banks, 1905: 56.

Togoperla Sp. A Frison, 1935: 414.

DISTRIBUTION IN LOUISIANA: LIVINGSTON, Tickfaw R. ST. HELENA, Amite R. TANGIPAHOA, Tangipahoa R. WASHINGTON, Bogue Chitto R.; Hays Cr.; Pushpatapa Cr.

This species is generally distributed over the midwestern states and south to the Gulf Coastal Plains. Present Louisiana records are from the Florida parishes (Fig. 17), and it has not been reported west of the Mississippi in the southern part of its range in other recent studies (Stewart et al. 1974; Stark and Stewart 1973). Adult genitalia were figured by Frison (1937) and the nymph by Frison (1935). Female nymphs of this species differ from Frison's description in having a small tuft of anal gills. The life cycle is unknown.

Phasganophora capitata (Pictet)

Perla capitata Pictet, 1841: 214.

Perla tristis Hagen, 1861: 22.

Perla annulipes Hagen, 1861: 22.

Perla flavescens Walsh, 1862: 363.

Perla hieroglyphica Provancher, 1876: 211.

Perla marginipes Provancher, 1876: 212.

Perla americana Banks, 1900: 243.

Perla: illustris Banks, 1908: 256.

Perla innota Banks, 1918: 6.

Harrisiola nigriscens Banks, 1948: 119.

Harrisiola klapaleki Banks, 1948: 121.

Harrisiola modesta Banks, 1948: 121.

DISTRIBUTION IN LOUISIANA: TANGIPAHOA, Tangipahoa R.; Terry Cr.: 1.5 mi E Amite (Fig. 17).

This species is widely distributed over the eastern United States and Canada but has not been found west of the Mississippi River in the southern part of its range. Although common in much of the Gulf Coastal Plains area, the species is a rarity in Louisiana. Illustrations of adult genitalia, nymphs, and eggs are given by Frison (1935) and Stark and Gaufin (1976a). Harper (1973a) presented data on the emergence, oviposition, hatching, and growth of the species in Canada.

Acroncuria abnormis (Newman)

Perla abnormis Newman, 1838: 177.

Perla sonans Newport, 1851: 449.

Acroncuria eidmanni Samal, 1933: 96.

DISTRIBUTION IN LOUISIANA: GRANT, Big Cr. LASALLE, Trout Cr. LIVINGSTON, Little Natalbany R.; Tickfaw R. RAPIDES, Brown Cr.; Castor Cr.; Hemphill Cr. TANGIPAHOA, Chapepeela Cr.; Tangipahoa R.; Terry Cr. TANGIPAHOA-ST. TAMMANY, Tchefuncta R. WASHINGTON, Silver Cr.; Tchefuncta R.

This is the most widely distributed *Acroncuria* in North America; however, in Louisiana it is somewhat of a rarity. The distribution shown in Figure 18 reflects several specific locations but most of these collections consist of one or two specimens. Stark and Gaufin (1976b) presented illustrations of male and female genitalia and eggs; Frison (1935) figured the nymph. Biological data are not available for the species.

Acroncuria arenosa (Pictet)

Perla arenosa Pictet, 1841: 178.

Perla pennsylvanica Rambur, 1842: 456.

Perla trijuncta Walker, 1852: 153.

DISTRIBUTION IN LOUISIANA: BEAUREGARD, Bুদ্ধick Cr. GRAND, 3 mi NW Dry Prong, near Pollock. LASALLE, Trout Cr. LIVINGSTON, Tickfaw R. NATCHITOCHEs, Middle Cr. RAPIDES, Brown Cr.; Castor Cr.; Germany Branch; Hemphill Cr.; Indian Cr. TANGIPAHOA, Big Cr.; Chapepeela Cr.; Natalbany R.; Terry Cr. WASHINGTON, Little Silver Cr.; .5 mi E Enon; Jct. Hwy. 10-62.

This species ranges from Pennsylvania down the Atlantic Coast to Florida and westward in the Gulf Coastal Plains to Texas (Stark and Gaufin 1976b). In Louisiana, it has been taken in a variety of streams ranging from small creeks to medium-sized rivers. Populations are centered in the Florida parishes and in the Kisatchie National Forest area (Fig. 18). Illustrations of the male and female genitalia and the egg are presented by Stark and Gaufin (1976b): the nymph is indistinguishable from Frison's (1935) *Acroncuria* sp. A illustration. No data are available on the biology of this species.

Acroncuria evoluta Klapalek

Acroncuria evoluta Klapalek, 1909.

Acroncuria arida Frison (Not Hagen), 1935: 395.

Acroncuria prolonga Claassen, 1937: 42.

DISTRIBUTION IN LOUISIANA: ORLEANS, New Orleans (Fig. 18).

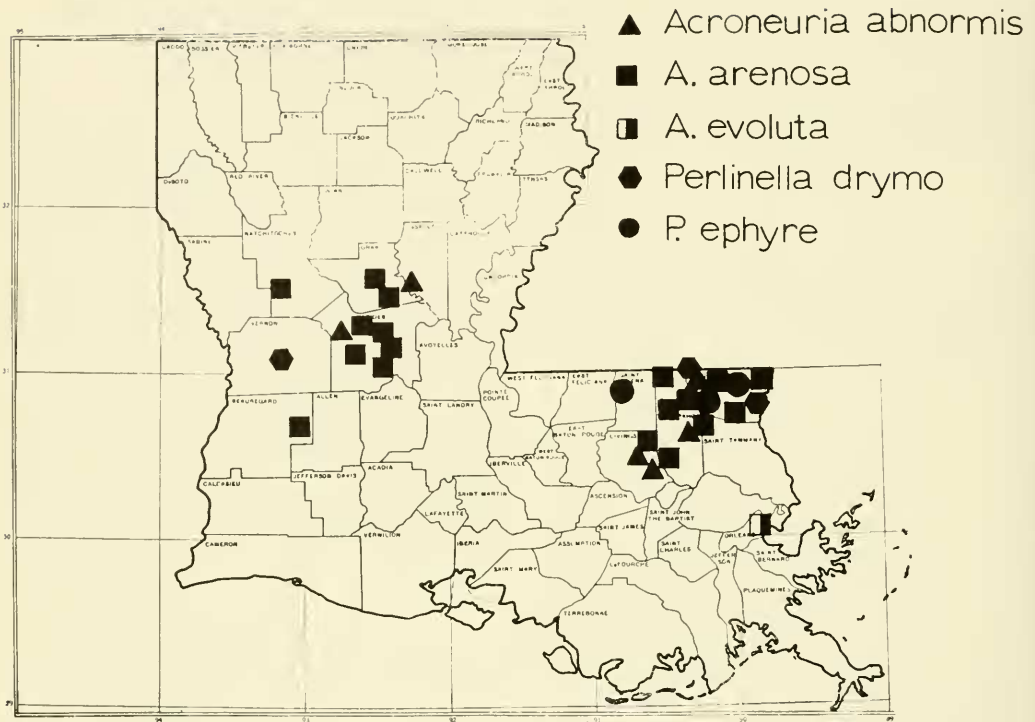


Fig. 18. Distribution of Acroneurinae (excluding *Perlesta*) in Louisiana.

The name *evoluta* has been applied by Frison (1947) to a midwestern species that ranges south into the Oklahoma Ozarks. It is doubtful if this midwestern form is the same as the type specimen which came from New Orleans. Stark and Gaufin (1976b) suggest Klapalek's *evoluta* types may be synonymous with Frison's *mela*; however, this specimen needs to be examined before the matter can be settled.

Perlesta placida (Hagen)

- Perla placida* Hagen, 1861: 28.
Perla decipiens Walsh, 1862: 364.
Perla brunneipennis Walsh, 1862: 367.
Chloroperla virginica Banks, 1898: 199.
Perlinella cincipes Banks, 1905: 56.
Isoperla texana Banks, 1914: 611.
Perlesta costalis Klapalek, 1921: 150.
Perlesta virginica immaculata Klapalek, 1921: 150.
Perlesta placida nitida Banks, 1948: 115.

DISTRIBUTION IN LOUISIANA: BEAUREGARD, Bayou Anococo. BIENVILLE, unnamed stream. BOSSIER, 9 mi E Red River. CADDO, 3 mi N Jct. 525-169. CATAHOULA, Tributary Birds Cr. DESOTO, 3 mi E Mansfield, 4 mi N Logansport. GRANT, Fish Cr.; Hardtner; Pollock. LASALLE, Hemphill Cr.; Trout Cr. LINCOLN, Bayou D'Arbonne. LIV-

INGTON, Little Natalbanie R.; Magnolia; Tickfaw R.; Natchitoches; Kistachie Cr.; Middle Cr.; Winn Cr. RAPIDES, Brown Cr.; Castor Cr.; Cherrywinche Cr.; Germany Branch; Roaring Cr.; Spring Cr. 2 mi S Calcasieu. RED RIVER, Grand Bayou. SABINE, Blackwell C.; Crib Cr.; 3 mi N Many. ST. HELENA, Amite R. TANGIPAHOA, Chapepeela Cr.; Natalbanie R.; Tangipahoa R.; Tchefonctia R.; Terry Cr.; Wilson Branch. VERNON, Comrade Cr.; Fort Polk; Whiskey Chitto Cr. WASHINGTON, Bogue Chitto R.; Hays Cr.; Little Silver Cr.; Mill Cr.; Silver Cr.; Tchefonctia R. WEBSTER, Sawsman Cr.

This is the most abundant and widely distributed Louisiana stonefly (Fig. 19). Nymphs have been collected in gravel, leaf litter, and debris; adults have been taken in May and June by sweeping vegetation or at light traps. Illustrations of male and female genitalia are presented by Frison (1935), Stewart et al. (1969), and Stark and Gaufin (1976a). Frison (1935) figured the nymph and commented on its carnivorous food habits. Photomicrographs of eggs were given in Stewart et al. (1969) and Stark and Gaufin (1976a). The egg (Fig. 23) is oval with a distinctly stalked collar. The lip of the collar is bent outward and has ir-

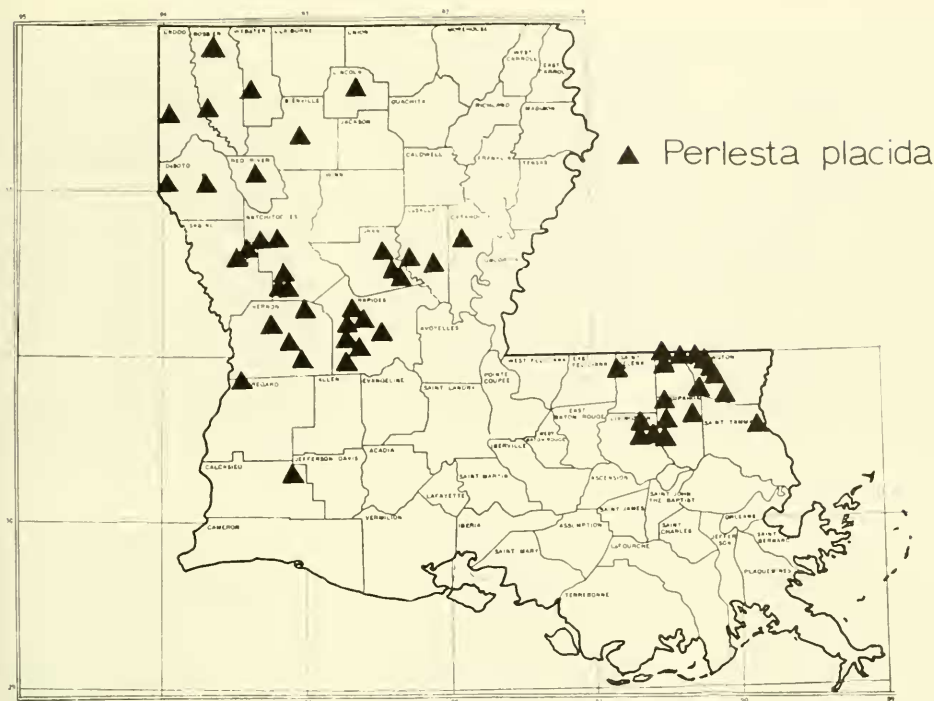


Fig. 19. Distribution of *Perlesta placida* in Louisiana.

regular sharp emarginations. Chorionic reticulation is not evident. No data are available on the growth cycle of this species; however, the appearance of only very small nymphs from November to January suggests a summer egg diapause and very rapid spring growth in southern latitudes. Stewart et al. (1969) discussed the mating behavior of Texas adults.

Perlinella drymo (Newman)

Isogenus drymo Newman, 1839: 86.

Perla elongata Walsh, 1862: 366.

Perla trivittata Banks, 1895: 313.

DISTRIBUTION IN LOUISIANA: VERNON, unnamed stream. WASHINGTON, Bogue Chitto R.: Little Silver Cr.: Jct. Hwy. 10-62.

This widely distributed eastern species is rare among collections from Louisiana at present (Fig. 18). Zwick (1971) figured male and female genitalia, and Stewart et al. (1974) reviewed the southwestern distribution. Stark and Gaufin (1976a) figured male and female genitalia, eggs, and selected characters of the nymph. Frison (1935) figured the whole nymph and discussed the microdistribu-

tion and food habits of this species. The egg (Fig. 25) is oval, lacks chorionic reticulation, and has a small, elegantly stalked collar topped by a massive mushroom-shaped anchor plate.

Perlinella ephyre (Newman)

Chloroperla ephyre Newman, 1839: 87.

Perla producta Walsh, 1862: 365.

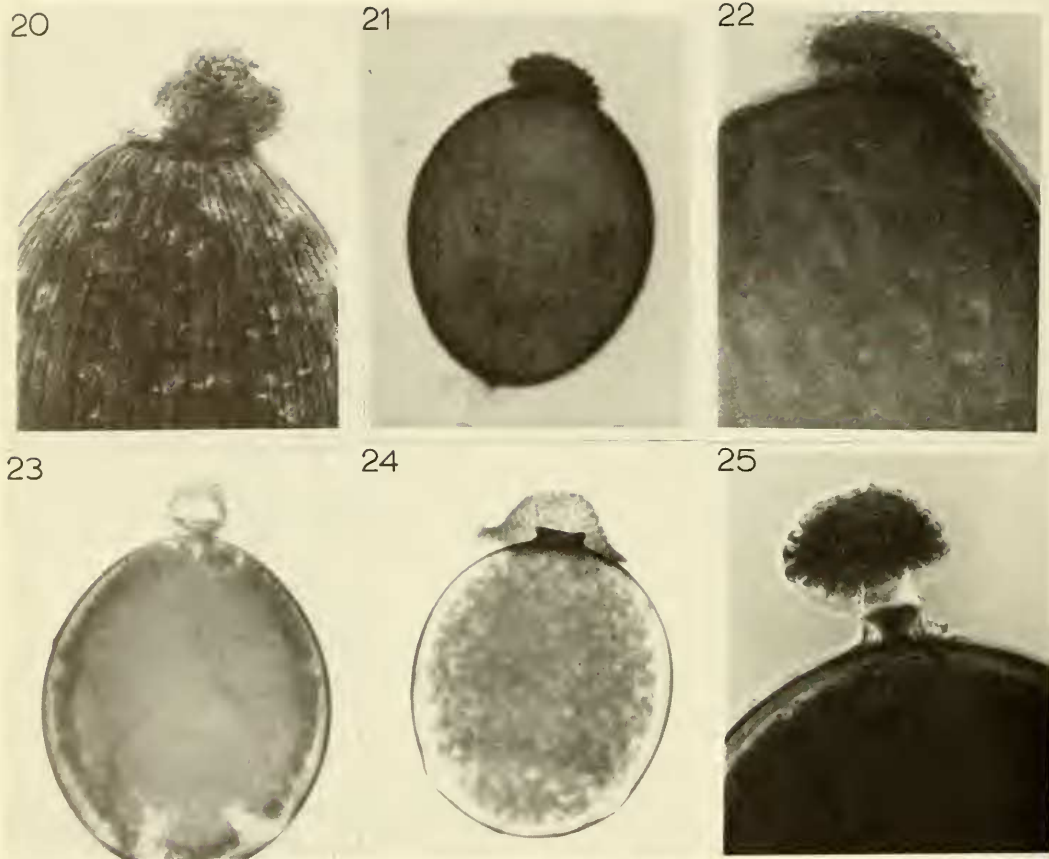
Atoperla consors Banks, 1948: 128.

DISTRIBUTION IN LOUISIANA: ST. HELENA, Amite R. WASHINGTON, Bogue Chitto R.: Harp Cr.; Pushpatapa Cr.

This species is widely distributed across the American midwest and Gulf Coastal Plains. We have collected it only in the Florida parish portion of Louisiana (Fig. 18), and it has not been taken west of the Mississippi in the southern part of its range. Details of male and female genitalia were figured by Zwick (1971); the nymph was illustrated by Frison (1935). No biological data are available for this species.

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We are greatly indebted to Dr. Joan B. Chapin, Louisiana State University at



Figs. 20-25. Photomicrographs of stonefly eggs: 20, *Neoperla clymene*, Etowah River, Georgia; 21, *Neoperla* sp. A. Blackwater River, Florida; 22, *Neoperla* sp. A. Blackwater River, Florida; 23, *Paragnetina fumosa*, Jasper, Texas; 24, *Perlesta placida*, Etowah River, Georgia; 25, *Perlinella drymo*, Blackwater River, Florida.

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